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DEPARTMENT OF THE ARMY
Fort Detrick
Frederick, Maryland

AN AUTOMATIC OPERATING SPRAYING INSTRUMENT FOR DOING

LABORATORY EXPERIMENTS WITH HERBICIDES

(Following is the translation of an article by F. Kersting. Plant Division, Department of Agriculture, Lippe, Muenster, published in the German language periodical Mitteilungen aus der biologischen bundesanstalt fuer land- und forstwirtschaft, Berlin-Dahlem 121, pages 285-288, (1967). Translation performed by Constance L. Lust.)

In the area of specialized lab investigations the dependence of the effect of soil conditions and other factors on certain herbicides, it was desirable to be able to duplicate all conditions as nearly to practical situations as possible, eg. surface uniformity, optimal distribution with the sprayer. For this it was particularly desirable to determine the extent and localization of the unavoidable errors in spraying.

In collaboration with an electric company (Huelsboemer and Weischer, Muenster, Wermelingstrasse 9A) in Muenster such an instrument was developed. This instrument largely conforms to the desired specifications (Figure 1).

A two meter high frame wall is connected perpendicular to a four meter long frame. On the vertical frame is mounted an adjustable top, which rests on the bottom piece with 4 legs (after adjustment downward). This serves as a rest for a plastic pan 1.2 meters by .3 m high. The containers to be used rest on this pan. The pan has water outlets. The frame wall carries two rails in its upper part, upon which the sled rolls. The sled is moved by cables from one end of the frame. A direct current moter (1/3 horse power) with special transmission is provided for this movement. Next to the motor is installed a switch and control panel.

The top (lid) of the spray liquid container (1.8 liters) made of light metal is attached with a console to the moveable sled. The liquid container can be easily detached via a fast clutch. The sled also carries a cartridge on two struts separated at a distance of 55 cm. This cartridge is at a height of 1.1 meter near the adjustable nozzle holder. Directly in front of the nozzle is attached a magnetic valve which automatically controls the stream of liquid via a contact switch located on the lower rail in certain places. Adjacent to this in the sled is an air pressure "equalizer" with a manameter and outfitted with a high pressure release valve.

The desired pressure to spray is provided by a portable compressor. The pressure is adjusted with a pressure valve which is dependable and sensitive; located under the switch board of the instrument.

The compressed air from the compressor is passed thru the pressure valve from one pressure chamber to a second pressure chamber and into the liquid container. The liquid flows thru a rubber tubing, attached to the bottom of the container, to the magnetic valve and to the nozzle. The pressure drop is negligible.

The sled rides a definite distance with constant velocity (can be varied between 0.5 and 3.0 Km.) along the edge and is stopped via a contact switch which is attached shortly before the end on the lower portion of the rail.

After standardizing the velocity of the sled in reference with exact measurements of amount of liquid sprayed on an area one can calculate the same dose. By using the same speed with known noxxles (of certain capacity) an exact dose of spray for an area can be obtained.

Figure 2 shows a standard table for the nozzles used (low trajectory spraying nozzle). With these nozzles a satisfactory distribution pattern is achieved at a height of 55-70 cm. The width of the spray is 0.7-0.8 meters (using only the middle field of the spray sled).

The constancy of distribution, measured on a tin tray, is presented as an average result of 4 individual measurements (Figure 3). With those nozzles (with the exception of type Teejet) the deviations from the average spray distribution all lie in within ±10%. Also with a new type of "Drall" nozzle the deviations were ±10%.

Just as important as a good distribution is the reproducibility that a certain spray distribution can be repeated within a known error range. We succeeded well with the flat spray nozzles and with the Drall nozzles. With these types one can work out any desired pattern. In this way the possibility arises that the unavoidable errors can be localized within the regular distribution. This is done by the vessels which are held exactly in place on the spray track during the spraying operation.

It is to be expected that still better consistancy of spray distribution is forthcoming and that still better distributions will be accomplished generally. By combining nozzles in definite limits more standard treatment of large plants will be possible. By extending the frame one may also reach higher constant working speeds.

In summary: An advantage of this instrument is that the desired dose can be achieved within an accurate distribution within a known limit of error. This is done easily and reproducibly.

Summary

An electrically controlled, automatic sprayer for laboratory-tests is described. This sprayer is equipped with selected single spray nozzles (flat-spray nozzles) or combinations of spray nozzles (hollow-cone spray nozzles). These are led across the object to be treated in a constant

speed. The output of spray solution can be varied by request from 200 to 600 l/ha. The constant spray distribution is exactly layed down for each spray nozzle or combination of spray nozzles. Only very few of the recorded results show a difference of more than ±10% from the mean-value. Unavoidable deficiencies in uniform distribution of the spray solution can be exactly localized.

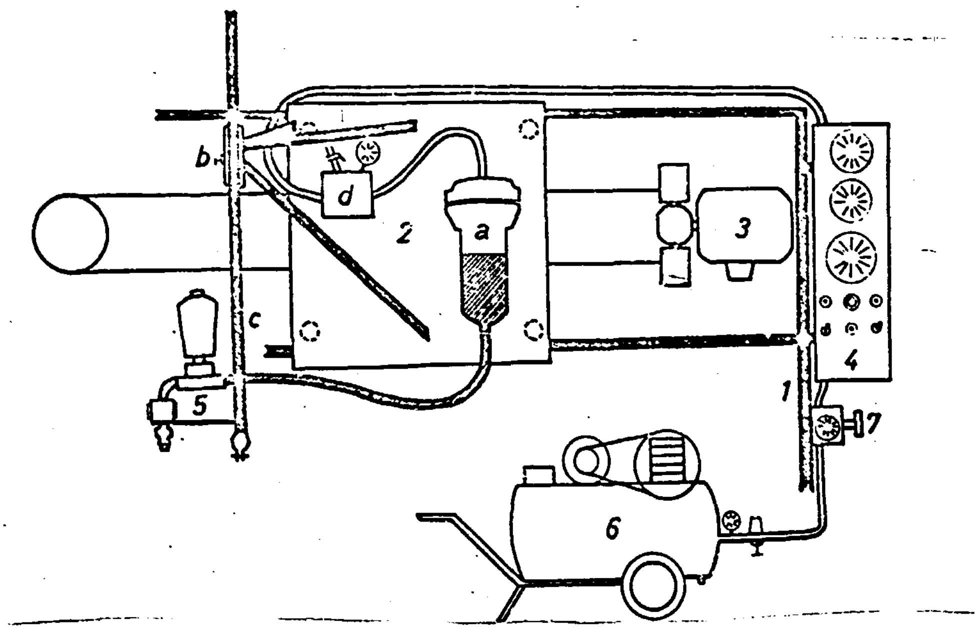

Figure 1. Scheme for automatic "trial sprayer machine Muenster"

1. Frame (profile iron)
2. Carriage moveable via cables
   a. container for liquid
   b. jacket for jet holder
   c. jet holder
   d. pressure equilization container II
3. Motor (direct current)
4. Switch board
5. Magnetic valve
6. Compressor with pressure container I
7. Pressure valve

Figure 2 "Trial Sprayer Muenster"
Standard table for nozzles at 3 atmospheres

l/ha	Nozzle #4 8002 E		Nozzle #5 8004 E		Nozzle #5 8006 E		Nozzle #10 11,5/90°	
	Wert	km/h	Wert	km/h	Wert	km/h	Wert	km/h
200	100	1,55	161	2,65	—	—	--	—
300	82	1,16	120	1,95	169	3,00	143	2,47
400	73	1,00	98	1,52	137	2,33	119	1,93
500	—	—	91	1,36	117	1,89	105	1,69
600	—	—	83	1,18	103	1,64	95	1,44
800	—	—	—	—	90	1,34	80	1,10

Figure 3 - Distribution consistancy of a Lechler nozzle 11.5/90° on 0.8 m spray width at a distance of 0.55 m between nozzle and surface (measured on corrugated tin). Four individual measurements showing relative constancy of spraying